Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

REVIEWS

SUMMARY OF THE LITERATURE OF NORTH AMERICAN PLEISTOCENE GEOLOGY 1901 AND 1902. III.

FRANK LEVERETT.

UNITED STATES.

PENNSYLVANIA.

CAMPBELL, M. R. *The Masontown-Uniontown Folio.* Geol. Atlas of the United States, U. S. Geol. Survey, Folio 82, 1902.

The matters pertinent to this review are the drainage features and the Pleistocene deposits. The valleys of the main streams in this folio, as in much of western Pennsylvania, carry gradation plains into which deep and comparatively narrow trenches have been cut since the beginning of glaciation. The trenches have not yet extended to the headwaters of the tributaries. The Monongahela has made singular departures from its old course, which the author thinks are attributable to blockades of the old courses by river ice concurrent with the glaciation in districts to the north, a view which he had previously expressed in the Huntington, W. Va., Folio. (See Review.) Prior to the cutting of the trench, and coincident perhaps with the diversion of the river into its new course, the valley became filled greatly with alluvial material, but much of this filling has been removed by interglacial and postglacial stream erosion. The rock floor stands about 900 feet above tide, or not far from 150 feet above the river, but the filling reaches 250 feet or more above the stream.

GRIFFITH, WILLIAM. *An Investigation of the Buried Valley of Wyoming* [Pennsylvania]. Proc. Wyoming Hist. and Geol. Soc., Vol. VI, pp. 27–36, with map, 1901.

The valley is filled with gravel and sand and coarser drift to the depth of 200 or 300 feet. Were this filling removed, there would be a lake eighteen miles long and a mile in width, through which the Susquehanna River would flow. This river now flows along the surface of the gravel bed, but slightly impinging upon the rock rim. It is evident that this gravel is permeated by water, for sometimes in mining operations both gravel and water rush into the mines that pass into the limits of the gorge, and this has been the cause of much difficulty and some fatalities in the mining of the coal at Wilkesbarre. (From review by N. H. Winchell in *American Geologist*, Vol. XXVIII, p. 324.)

WILLIAMS, E. H. *The Alleged Parker Channel.* Bull. Geol. Soc. Am., Vol. XII, p. 463, 1901.

The view is presented that the oxbow, which had hitherto been referred to the preglacial Clarion River, is instead made up of two short side valleys that headed on opposite sides of a low col and debouched into the Allegheny within a mile of each other. In glacial time these two valleys were greatly filled by gravel brought down the Allegheny, and also by wash from adjacent hills.

The reviewer has given indorsement to this view in Monograph XLI, *U. S. Geological Survey* (p. 242), but subsequently, upon visiting the region in company with M. R. Campbell and M. L. Fuller, it was found that the contours of the valley are such as strongly to support the earlier interpretation, and the oxbow channel appears to have been abandoned through a sapping which enabled the stream to pass directly across the neck.

WILLIAMS, E. H. *Kansas Glaciation and its Effects on the River System of Northern Pennsylvania.* Proc. Wyoming [Pennsylvania] Hist. and Geol. Soc., Vol. VII, 8 pp., 11 Pls. and Figs., 1902.

The early glaciation in the anthracite region removed portions of the roof or capping of the coal, so that it is mined by stripping the drift. The old drift at West Bethlehem has a known thickness of 165 feet. Changes of drainage in the Lehigh River worked out by Joseph Barrell are noted; also evidence that the ice so blocked the Susquehanna near Williamsport that a glacial lake, called Lake Lesley, was formed, which had its discharge into the Juniata valley at Tyrone. Connected with this were several ephemeral slack waters still further up the west branch of the Susquehanna and the Sinnemahoning.

In northwestern Pennsylvania the advancing ice blocked the northward flowing drainage system, as shown by Carll, and the slack water found discharge down the Allegheny past the col at Thompson and down the Tionesta from Barnesville. There was a deep filling of sand and rock meal before the coarse glacial material was spread over this region.

OHIO.

CLARK, W. BLAIR. *Drainage Modifications in Knox, Licking, and Coshocton Counties.* Denison Univ., Sci. Lab., Bull. Vol. XII, Art. 1, pp. 1–16, Pls. I–III, 1902.

Not examined.

LEVERETT, FRANK. *Glacial Formations and Drainage Features of the Erie and Ohio Basins.* Monograph XLI, U. S. Geol. Survey, 802 pp. 26 Pls., and 8 text Figs., 1902.

The area treated in this monograph extends from the Genesee valley in New York westward across northwestern Pennsylvania and Ohio to central and southern Indiana, and southward from Lakes Ontario and Erie to the vicinity of the Allegheny and Ohio rivers. It embraces a district ranging in altitude from about 250 feet up to nearly 2,500 feet above sea-level, the highest points being in southwestern New York, and the lowest on the border of Lake Ontario. There are plains south of Lake Ontario separated by escarpments, and south of these is a greatly eroded tableland. Farther west are the Grand River and Scioto basins bordered by eroded tablelands, and still farther west is the low plain of the central Mississippi basin whose eastern border is found in western Ohio. Attention is directed to important changes of drainage which have occurred, and the causes of these changes are treated briefly.

The drift border or glacial boundary is not a unit, but is formed in part by the border of the Wisconsin drift, in part by the Illinoian drift, and in part by a sheet of drift that appears to be still older than the Illinoian which may be either Kansan or pre-Kansan. This oldest drift is exposed outside the Wisconsin drift in northwestern Pennsylvania, and is shown to have suffered a greater amount of erosion and weathering than the Illinoian drift. The Illinoian drift is exposed outside the Wisconsin drift from central Ohio westward to the Mississippi River, but is discussed only as far west as the re-entrant angle in the glacial boundary in southern Indiana, the portion farther west having been discussed in Monograph XXXVIII. The main topics considered are structure, topographic expression, and the character of the glacial drainage.

The weathered zone and accompaning soils and peat beds which occur between the Illinoian drift and the overlying loess are described in their exposures outside the Wisconsin drift, and to some extent within the limits of that drift.

The Iowan drift does not appear to be exposed in this region outside the Wisconsin drift, but a deposit of silt with loess-like characteristics occupies the horizon of this drift-sheet, and covers the weathered surface of the Illinoian drift. There appears to have been but a brief interval between the deposition of this silt and the Wisconsin glaciation, if we may judge by relative amounts of weathering. An interval of some importance may be inferred from the change in the attitude of the land by which better drainage conditions became prevalent in the Wisconsin stage of glaciation than attended the loess deposition. The marked difference in the outline of the Iowan and Wisconsin borders also indicates an interval of some consequence.

The early Wisconsin drift is less extensively exposed in this region than in that covered by the Illinois glacial lobe discussed in Monograph XXXVIII, there being in southwestern Ohio but one moraine and narrow till plain which seem referable to this drift, while in central and eastern Ohio and northwestern Pennsylvania it is not known to be exposed. The evidence of an interval between the early and late Wisconsin glaciations is more clearly shown in the region covered by the Illinois glacial lobe than in this region, for there the border of the outer moraine of the late Wisconsin group is strikingly discordant with that of the neighboring moraine or moraines of the early Wisconsin group, while in this region there is not a marked discordance.

The moraines of the late Wisconsin stage consist of an outer or main morainic system, which was brought to notice by Chamberlin in the *Third Annual Report of the U. S. Geological Survey*, and several minor moraines which appear in a somewhat regular succession between the main morainic system and the Lake Erie basin. Eskers are found in Ohio, Pennsylvania, and New York on the till plains between the moraines, but drumlins are restricted to the western New York portion of this region.

The great glacial lakes, Maumee, Whittlesey, and Warren, which were formed in front of the retreating ice-sheet as it withdrew into the Huron and Erie basin, are each shown on double-page maps, while their beaches and outlets are discussed in some detail. A marked warping of the beaches in Pennsylvania, western New York, and the province of Ontario testifies to differential uplift which has occurred since the ice retreated from this region, and which apparently is still in progress. The portion of the beaches in Ohio shows very little warping or differential uplift.

The monograph closes with a discussion of the soils, which are classified according to their origin, the following classes being recognized: residuary soils, bowlder-clay soils, gravelly soils, sandy soils, loamy soils grading into fine silts, peaty or organic soils.

MOSELEY, E. L. *Submerged Valleys in Sandusky Bay.* Nat. Geog. Mag., Vol. XIII, pp. 398–403, 1902.

Borings made in Sandusky Bay, have brought to light an old channel of the river and channels of some of its tributaries leading across the bed of the bay. They are nearly filled with a much softer deposit than the till of which the banks and the bordering submerged plain is composed. This evidence is in harmony with several lines noted by the author in other publications in support of the view that the water area is being extended at the west end of the Lake Erie basin, the principal lines being submerged stalactites in caves, submerged areas formerly covered by forests, the testimony of the flora of the islands to a former connection with the mainland, the observations of old residents as to encroachments made in the past eighty years, and gauge readings at Erie and elsewhere that show the water to have been lower at times in the first half of the nineteenth century than it has been since. In explanation of this extension of the lake the author cites the results of Gilbert's studies which indicate that a northward differential uplift is now in progress.

PIERCE, S. J. *The Cleveland Water Supply Tunnel.* Am. Geol., Vol. XXVIII, pp. 380–85, 1901.

A tunnel extended 26,000 feet under Lake Erie with a depth of 100 feet below lake level at the shore and 110 feet at the lakeward end is entirely through a stratified blue clay with thin partings of fine sand. The sand partings are from one-sixty-fourth to one-eighth of an inch thick, and separate the clay bed into layers three-fourths to one and a half inches thick. The bedding is generally horizontal, but shows some wave action, cross-bedding, and folding. Chemical analyses of the sand and the clay show them to be strikingly similar in composition where samples were taken close together, but some variation is found in different parts of the tunnel. Fragments of rock up to eighteen inches in diameter are imbedded in this deposit, and they vary greatly in the amount of water wear and glacial scratching. Many are syenites and, with the exception of a moderate number of local shales and sandstones, the rocks are of distant derivation.

The paper concludes with an account of test borings made near the mouth of the Cuyahoga that suggest to the author a continuation of the river channel under Lake Erie, but this is 85 feet below the surface of the lake and may admit of a very different interpretation, the data being, in the reviewer's opinion, insufficient to warrant definite conclusions. The preglacial valley of the Cuyahoga has been found, by borings made by the author, to have a bed about 450 feet lower than the surface of Lake Erie, or not far from 125 feet above tide.

INDIANA.

BLATCHLEY, W. S.. and ASHLEY, G. H. *The Lakes of Northern Indiana and Their Associated Marl Deposits.* Twenty-fifth Rept. Geol. Survey Indiana, pp. 31–233, 248–321, Pls. I and VI–XII, Figs. 1–70, 1901.

Lakes are classified as kettleholes, channel, and irregular depressions. The agencies of extinction mentioned are: material brought in by streams and springs, decrease of water supply from seepage, artificial drainage, and, most important of all, replacement by muck formed through the decay of aquatic vegetation.

Marl deposits occur chiefly in the three northern tiers of counties. They range in area from a fraction of an acre up to about 1,700 acres, but the majority fall below 100 acres. The thickness is known to reach 45 feet, and a large majority of the lakes appear to have a deposit 20 feet or more in depth. The marl is thought to be deposited from spring water through the loss of carbon dioxide caused in three ways: (1) by the increase in temperature: (2) by decrease in pressure; (3) by abstraction of the carbon dioxide to supply plant food.

Maps of many of the lakes are presented with a legend by which the marl conditions may be easily read. The descriptions in the text are full, and the value and accessibility of marl in each lake is clearly indicated.

BREEZE, FRED, J. *The Valley of the Lower Tippecanoe River.* Proc. Indiana Acad. Sci., for 1901, pp. 215, 216, 1902.

A map and description set forth the width of the valley and meanders of the stream.

CAMPBELL, JOHN T. *Evidence of Local Subsidence in the Interior.* JOUR. GEOL., Vol. IX, pp. 437,‡38, 1901.

Recent levelings of a locality in western Indiana, where bench-marks were established in 1883, show a slight decline southward. The Charlestown earthquake is suggested as a cause for the subsidence.

DRYER, C. R. *Eskers and Esker Lakes of Northeastern Indiana.* JOUR. GEOL., Vol. IX, pp. 123–29, 1901.

The name "esker lakes" is suggested for bodies of water occupying depressions closely connected with esker ridges.

FULLER, M. L. *General and Pleistocene Geology of the Ditney, Indiana, Folio.* Geol. Atlas of the United States, U. S. Geol. Survey Folio, No. 84, pp. 1–7, 1902.

The drainage and Pleistocene deposits are the chief topics pertinent to this review. The main drainage lines of southwestern Indiana became re-established after glaciation, but many of the smaller streams have suffered deflections or diversions as a result of an obstruction by the ice-sheet, drift, or glacial outwash. Little Pigeon and Cypress creeks, however, have been but slightly affected.

The Illinoian drift-sheet constitutes the main member of the glacial series within this quadrangle. There are deeply oxidized sand and gravel deposits found in patches outside the limits of the well-defined drift-sheet and also scattered pebbles, which may prove to belong to an older sheet of drift than the Illinoian. There are also a loess and a black soil beneath the Illinoian drift which are of undetermined age. The main deposit of loess is found above the Illinoian drift and is apparently of Iowan age. The loess along the Wabash valley up to a certain level is stratified, occurs in definite terraces, and appears to be of aqueous deposition, while at higher levels it is thought to be wind-deposited. Certain sand deposits along White River valley are considered of Wisconsin age, but most of the alluvium is post-Wisconsin.

HEINEY, W. N. *River Bends and Bluffs.* Proc. Indiana Acad. Sci. for 1900, pp. 197–200, 1901.

The paper discusses a very crooked section of Salamonie River in southern Huntington county, Ind., and is illustrated by sketch maps and a profile showing how the bend has been extended by the stream.

MCBETH, W. A. *The Development of the Wabash Drainage System and the Recessions of the Ice Sheet in Indiana.* Proc. Indiana Acad. Sci., for 1900, pp. 184–92, 1901.

This paper dissents from interpretations made by Chamberlin and Leverett that in the Wisconsin stage of glaciation the ice from the Huron-Erie basin covered Tippecanoe, White, eastern Benton, southern Newton, and southern Jasper counties, and receded eastward from these counties. The author maintains instead that the ice from the Lake Michigan basin overspread nearly the whole area of these counties, and that its recession was northwestward. The sketch maps which accompany the paper represent several supposed outlines of the ice margin in the course of its retreat. The author's interpretation and mapping are not supported, however, by the distribution of moraines, border drainage channels, and other features which are commonly used by glacialists in determining the outline which an ice-sheet presented at a given time. Instead other features are taken to indicate the position of the ice margin. In one case a change from a level to an inclined plain, in another the irregularities of the Wabash bluff produced by postglacial drainage, appear to have been interpreted as marginal features.

McBETH, W. A. *A Theory to Explain the Western Indiana Bowlder Belts.* Proc. Indiana Acad. Sci. for 1900, pp. 192–94, 1901.

The bowlder belts are interpreted to be a sort of beach formation, produced by the stranding of icebergs and floe ice in shallow lakes.

McBETH, W. A. *Wabash River Terraces in Tippecanoe County, Indiana.* Proc. Indiana Acad. Sci. for 1901, pp. 237–43, 1902.

The terraces are classified as high and low, the former being 80 to 130 feet above the river, and the latter but little above the modern flood plain. Reference is made to the occupancy of a preglacial valley by the Wabash throughout much of its course in Tippecanoe county, whose rock floor is about 150 feet below the present stream. A map repeats the views of earlier papers (reviewed above) as to moraines and lake beds.

McBETH, W. A. *History of the Wea Creek in Tippecanoe County, Indiana,* Proc. Indiana Acad. Sci. for 1901, pp. 244–47, 1902.

The creek is found to have its course governed by the slopes of the region, but the author thinks that its drainage basin was submerged for a time after the ice had disappeared, and it was not until the supposed lake had drained away that the creek began to open a course in conformity to the slopes.

MARSTERS, V. F. *Topography and Geography of Bean Blossom Valley, Monroe County, Indiana.* Proc. Indiana Acad. Sci. for 1901, pp. 222–37, 1902.

The valley of this creek is found to have been formed by a meandering preglacial stream. There has been a large amount of filling with earthy material, which also is found to antedate the deposition of the glacial material. The ice-sheet covered the head waters and also the lower end of the valley, but the middle portion is unglaciated. An arrest of drainage which resulted from this ice invasion is shown by the presence of benches along the valley borders where material was brought into the flooded valley by tributaries at levels considerably above the valley bottoms. These benches stand about 70 feet above the bottoms in northeastern Monroe county, but are only 25 to 30 feet above them in the northwestern part of the county. The difference is interpreted to be due to a greater accession of material in the higher benches than was received in the lower, rather than to different lake levels.

PRICE, J. A. and SHAAF, ALBERT. *Spy Run and Poinsett Lake Bottoms, and the Abandoned Meanders of Spy Run Creek.* Proc. Indiana Acad. Sci. for 1900, pp. 179–84, 1901.

The features here discussed appear in a small valley one and one-half miles northwest of Fort Wayne, and north of the Fort Wayne outlet of Lake Maumee. It is thought that lakes were present in this valley which have become converted into swamps by the influx of material washed from the bluff. The meandering of the creek over the bottom of Spy Run Lake basin forms the concluding topic.

SCOVELL, J. T. *Lake Maxinkuckee.* Twenty-fifth Rept. Geol. Survey Indiana, pp. 233–47, 261–65, 1901.

The features surrounding the lake and also the features of the lake bottom are set forth by description and map. The flora of the lake is presented in a list of about 150 plants, not including 50 which are found along the beach. The lake contains a large workable deposit of marl, which is thought to have had its origin through the separation of calcic carbonate from the water by mollusks and different species of *Chara.* An attempt made to form a rude estimate of the quantity of the carbonate of lime deposited each year gave 0.01 inch as a conservative amount. Assuming the average thickness of the deposit to be ten feet, about 12,000 years would be necessary to provide for the accumulation of the marl. It is, however, thought probable that the rate of deposition was more rapid in the past, so that the age of the lake may be considerably less than 12,000 years.

SIEBENTHAL, C. E. *Topography, Pleistocene Deposits and Drainage of the Hydraulic Limestone Area in Southern Indiana.* Twenty-fifth Rept. Geol. Survey Indiana, pp. 359–64, 1901.

Borings are thought to indicate that the Ohio River formerly passed the Louisville rapids in a course slightly north of the present.

ILLINOIS.

ALDEN, WILLIAM C. *The Chicago Folio.* Geol. Atlas of the United States, U. S. Geological Survey, Folio 81, 1902.

This folio is very largely devoted to a discussion of Pleistocene features and deposits, for the rock outcrops in the Chicago area are few, and it is the drift that gives the topographic variations. The Valparaiso morainic system covers the western edge; the remainder is largely embraced in the plain occupied by Lake Chicago. The Chicago outlet, with its double-headed channel, forms a conspicuous feature in its passage through the moraine. The discussion of glacial deposits pertains mainly to the Wisconsin drift, though reference is made to exposures of earlier drift, and to the penetration of old drift in deep wells. The lake history is treated in considerable detail, and the several stages of Lake Chicago are shown by maps. In explanation of the lowering of the lake level from the upper to the second beach a suggestion of Chamberlin's is presented that the outlet may have cut back through the Valparaiso moraine by a stoping process until the barrier presented by the moraine was removed, and then lowering would rapidly take place. The changes in the present shore near the mouth of Chicago River which have occurred since 1821 are represented on a small map. The influence of the beaches of Lake Chicago on the course of Calumet River is also shown on a special map.

MICHIGAN.

GORDON, C. H. *The Port Huron Oil Field.* Report of State Geologist for 1901, pp. 269–82, 1902.

The thickness and character of the glacial deposits are given in connection with the well records, and attention is called to water supply from the gravel beds.

GORDON, C. H. *Wave Cutting on the West Shore of Lake Huron in Sanilac County, Mich.* Report of State Geologist for 1901, pp. 583–290, Figs. 6–8, Pls. XI–XV, 1902.

The amount of encroachment on the land from 1823 (when the government land survey was made) to 1901 was accurately surveyed on part of the shore, and found to average 6.81 chains, or 449.46 feet, an average of 5.7 feet per annum. Were the rate of cutting and transfer of material to the lake bed uniform for the entire 500 miles of coast, it would require 4,000 years to fill the lake one foot, and 800,000 years to fill the 200 feet of average depth. The rate of cutting here is thought, however, to be above the average, and the time required to fill the lake by this process is likely to be much longer than 800,000 years. The paper is well illustrated by maps and photographs of the shore.

GREGORY, W. M. *Preliminary Report on Arenac County, and Parts of Ogemaw, Iosco, and Alcona Counties.* Rept. of State Geologist for 1901, pp. 9–29, 1902.

The report aims to bring to notice economic resources: limestone, gypsum, coal, clay and shales, water supply (especially flowing wells), and agricultural values. The glacial deposits and shores of glacial lakes receive very brief treatment.

The flowing wells are partly from gravel below till on the lakeward slopes of moraines, but many are extended into the rock.

LANE, A. C. *The Preglacial Surface of Lower Michigan.* Science, Vol. XIV, pp. 798, 799, 1901.

Rock outcrops in Saginaw Bay seem to oppose the interpretation made by Spencer that the central part of the southern peninsula drained through the bay. The borings favor the view that drainage was westward or northwestward. The available data are thought to indicate that the drainage from the Grand Traverse region was southward past Manistee, rather than northward toward the Straits of Mackinac.

LANE, A. C. *Deep Wells, etc.* Rept. of State Geologist for 1901, pp. 211–38, 1902.

The records of deep wells in southeastern Michigan, in the Port Huron district, in the northern part of the state, and on the Lake Michigan shore which are here presented, throw light upon the thickness and structure of the glacial deposits.

LEVERETT, FRANK. *Surface Geology of Alcona County, Michigan.* Rept. of State Geologist for 1901, pp. 35–64, 1902.

The physiography, glacial deposits, lake history, soils, wells, marl and clay deposits, and water power form the chief topics of discussion. Rocks included in the drift of this county bear witness to several ice movements, some having been brought from the northwest, others from the northeast, and still others from the southeast. The ice-sheet apparently persisted in the low tracts in the eastern part of the county until Lake Warren had been drained away, for no well-defined beach was found above the Algonquin.

McLouth, C. D. *Some General Remarks on the Topography, Soils, Water Sources, Flora, etc., of Muskegon County.* Rept. of State Geologist for 1901, pp. 104–107, 1902.

The county is largely a sand plain, except the townships of Whitehall, Montague, Casnovia, and Ravenna, in which the predominating soil is clay. The features indicate much oscillation in lake level. The sand plain was covered by Lake Chicago up to a height of perhaps 75 feet above Lake Michigan, but deep-mouthed rivers apparently indicate a lake stage lower than the present surface of Lake Michigan. Flowing wells from the drift are common near the lake shore and range in depth from 35 feet at Montague to 250 feet at the south line of the county.

Sherzer, W. H. *Ice Work in Southeastern Michigan.* Jour. Geol., Vol. X, pp. 194–216, 1902.

The paper deals mainly with striation, and this is thought to be referable to four stages or episodes in the history of the Labrador ice-field; the Illinoian, Iowan, early Wisconsin, and late Wisconsin. The oldest movement is southwestward; the next, west-southwestward; the third, south-southwestward; and the fourth, mainly southwestward, but on the west side of the Huron-Erie lobe, northwestward toward its moraines. The lowering of the rock surface is thought to have been accomplished mainly in the first ice invasion. The amount of lowering in the three later ice invasions seems likely to be expressed in inches rather than in feet. The suggestion is made that this interpretation of greatest modification of rock topography at the earliest ice advance may also be applicable over the Great Lakes basins.

Taylor, F. B. *Surface Geology of Lapeer County.* Rept. of State Geologist for 1901, pp. 111–17, 1902.

This county, which is situated on the "Thumb" of Michigan, shows a range in altitude of about 500 feet, from 780 up to nearly 1,300 feet above tide. Five moraines traverse the county in a curving course convex to the north. These include a few clusters of sharp hills, but generally present a swell and sag topography. The Imlay outlet to Lake Maumee, brought to notice by the author's earlier studies, follows a sag between the third and fourth moraines, while earlier lines of glacial drainage which had their head in the ice-sheet in the eastern part of the county made use of sags between the first and second and the second and third moraines. The relative strength of moraines and the courses of glacial drainage are well brought out in a shaded map.

WISCONSIN.

Buckley, E. R. *Ice Ramparts.* (With a discussion by C. R. Van Hise.) Trans. Wis. Acad. Sci., Vol. XIII, Part I, pp. 141–62, Pls. I–XVIII, 1901.

The changes of temperature during the winter months cause sufficient expansion and contraction of the ice covering the inland lakes of Wisconsin to shove up the shore material into ridges, known as ice ramparts. The discussion pertains chiefly to ramparts on Lakes Mendota and Monona at Madison, Wis., formed in the winter of 1898–99, light precipitation and temperature conditions of that winter being exceptionally favorable for their development. The ice reached a maximum thickness of 30 to 40 inches, and shallow portions of the lake were frozen to the bottom.

Three forms of ramparts were observed: (1) along a sand or gravel beach of gradual slope, where the frozen lake bottom was shoved up the incline and left as a thin mantle upon the melting of the ice; (2) along an abrupt shore, were ice ridges were heaped up and bowlders from the lake bottom carried to heights of several feet above lake level, and in places the banks of the lake greatly disturbed; (3) at the head of bays occupied by mud, marl, and weeds, where the rampart has the shape of a more or less symmetrical fold. The folds are on the lakeward side of the shore where banks are abrupt, and on the landward side where they are very gradual, and on both sides where lakeward and landward conditions were balanced. In some cases a series of folds resembling the Appalachian Mountain structure was developed, features of which are noted below (in reviewing Van Hise's discussion).

The changes involved in the production of the ramparts are summarized as follows: (1) Beginning of freezing process. (2) Ice over the lake and temperature falling, ice thickens below and raises upper surface, setting up tensile stresses and producing surface cracks. The cracks receive water from below which freezes. Cracks open repeatedly until lowest temperature is reached, when the ice is approximately adjusted to the size of the lake basin at minimum temperature. (3) The temperature rises, compressive stresses are set up, and relief comes either through forming ridges in the ice or ramparts along the shore. Cracks also form from the under surface. (4) Freezing temperature, the water wells up into the cracks and freezes, and again the ice-sheet becomes a solid mass adjusted to the size of the basin, and the cycle of changes is completed.

In the discussion of this paper (pp. 158–62 of volume cited) Van Hise calls attention to analogies which the ice phenomena present to the crustal deformation of the earth, among which are noted: (1) the manner in which normal folds pass into overturned folds; (2) the successive development of folds; (3) the elevation of anticlines more than the depression of synclines; (4) the formation of folds at right angles to each other; (5) the combination of folds and faults; (6) the forcing of water up through cracks by the pressure exerted by synclines. The force acting upon the earth's crust is gravitative stress which comes from various causes, including changes in temperature, which is the controlling cause of ice ramparts.

COLLIE, GEORGE L. *Wisconsin Shore of Lake Superior.* Bull. Geol. Soc. Am., Vol. XII, pp. 197–216, 1901.

The paper deals with the shore phenomena of Chequamegon Bay and the Apostle Islands. These islands, it is thought, have resulted from the drowning of preglacial valleys. The strong topographic features of the mainland were produced in preglacial time, but glacial deposits have produced a marked influence on the topography.

Changes in lake level are found to involve a rise, now going on, as well as the lowering from high levels of glacial lakes that once occupied this lake basin. The recent rise is shown by two lines of evidence: (1) The lower courses of the streams tributary to the lake are drowned through the incursion of the lake water; (2) certain shore features, such as bars and spits, are in process of rapid destruction. The lake bars, island spits, tombolos, beaches (platform, barrier, cliff, and storm), shoals, lagoon and marsh, deposits, are considered, and also features produced by wave erosion, such as caverns, coves, cliffs, benches, and stacks. The last mentioned are small portions of rock cut off from the parent cliff through the action of waves in opening and enlarging the joint planes.

COLLIE, GEORGE L. *Physiography of Wisconsin.* Bull. Am. Bureau Geog., Vol. II, 20 pp., Winona, Minnesota, 1901.

Not examined.

FENNEMAN, N. M. *Development of the Profile of Equilibrium of the Subaqueous Shore Terrace.* JOURNAL OF GEOLOGY, Vol. X, pp. 1–32, 1902.

The profile of a shore at any given time is a compromise between the form it possessed when the water assumed its present level, and a form which the water is striving to give to it. While there are ever changing conditions with which no fixed form can be in equilibrium, there are certain adjustments of current, slope, and load which, when once attained, are held with some constancy, and the form thus involved is called the profile of equilibrium. The entire form may shift its position toward or from the land, but its slope will change little or not at all.

Waves are first considered in their free form in deep water where no external work is done, after which the various ways in which the bottom or shore may offer resistance and be subject to work by waves and currents is discussed in detail.

FENNEMAN, N. M. *On the Lakes of Southern Wisconsin.* Wis. Geol. and Nat. Hist. Survey, Bull., No. 8, 178 pp., 36 Pls., 38 Figs. in the text, 1902.

This bulletin is one of an educational series designed to assist students of physiography, and especially the teachers of the southeastern part of the state, in using the natural features of the region as an aid to instruction in physical geography and geology. The origin and history of the lakes and the features of their shores is discussed in some detail. The bulletin should be used in connection with a series of hydrographic maps which had been previously issued by the same survey.

Lake basins are classified under the headings: pits, erosion valleys blocked by drift, valleys between terminal moraine ridges, troughs of small glacial lobes, inequalities in the ground moraine. Under the heading, extinction of lakes, it is estimated that a great part of the material which contributes toward the filling of the lakes is obtained by the action of the waves upon the shores. Another important factor of extinction is the down-cutting of the outlet. The marl and vegetal accumulations are also factors of great influence. A chapter is devoted to the work of lakes upon their shores, in which the following topics are considered: waves and currents, shore forms due chiefly to cutting, shore forms due to transformation and deposition, shore forms due to ice, and cycles of shore lines.

The lakes discussed in this bulletin are: The lakes at Madison (chiefly Mendota and Monona), Lake Geneva, Delavan Lake, Lauderdale and Beulah lakes, Pewaukee, and Nagawicka lakes, Nashotah-Nemahbin chain of lakes, the Genesee lakes, Beaver, Pine, North, Mouse, Okauchee, and Oconomowoc lakes, Lac Labelle, Fowler and Silver lakes, Big and Little Cedar lakes, Elkhart Lake, and the Waupaca chain of lakes.

UPHAM, WARREN. *Pleistocene Ice and River Erosion in the St. Croix Valley of Minnesota and Wisconsin.* Bull. Geol. Soc. Am., Vol. XII, pp. 13–24, 1901.

The paper attempts to give a broad outline of the history of the St. Croix River, and especially of its upper and lower Dalles. The preglacial rivers which have contributed toward the production of the St. Croix valley, the glacial lake outlet which made use of this valley, and the work of the stream itself are each considered. Lakes

St. Croix and Pepin are due to recent and still progressing deposition of alluvium in valleys which were deeply eroded by outflow from glacial lakes.

MINNESOTA.

BROWER, J. B. *Kakabikansing.* St. Paul, Minn.: H. L. Collins & Co., Publishers, 1902.

Reviewed by T. C. Chamberlin in this JOURNAL, Vol. X, pp. 794–98.

UPHAM, WARREN. *Giant Kettles Eroded by Moulin Torrents.* Bull. Geol. Soc. Am., Vol. XII, pp. 25–45, 1901.

A description is given of very large potholes near Taylor's Falls, Minn., which are compared with other potholes both in North America and in Europe. Attention is called to the other ways in which potholes are produced (by subærial waterfalls and rapids), as well as by moulin torrents and subglacial streams. Those by the latter processes may have been formed in the early part of the glacial epoch, though some appear to date from the late part. It is thought they may be formed very rapidly, a single season perhaps being long enough to scour out one 20 to 50 feet deep.

WINCHELL, N. H. *Glacial Lakes of Minnesota.* Bull. Geol. Soc. Am., Vol. XII, pp. 109–28, Pl. 12, 1901.

This paper attempts to bring into one general view, with a brief description, the glacial lakes of Minnesota in their order of development. Twenty-six lakes are thus treated, many of which had not previously received names. The altitude of the outlet of each lake is given. The lowest is that of Lake Shakopee, 875 feet, and the highest, Lake Elftman, 1,700 feet. With this discussion of the lakes is given an account of the general manner of retreat of the ice-border. Attention is also directed to small glacial lakes along the Coteau de Prairie, which are not named, but have served to produce a remarkable topography. The paper closes with a reference to small lakes which laid in the deep gorges of the Mississippi within the driftless area and which owed their existence to glacial damming.

SOUTH DAKOTA.

TODD, J. E. *Moraines and Maximum Diurnal Temperature.* Science, Vol. XIV, pp. 794, 795, 1901.

From the fact that the moraines in the James River valley are wider and rougher on the west side of the valley than on the east, it is suggested in explanation that, the maximum diurnal temperature being higher after noon, the western half of an ice-lobe will receive more heat, and consequently be more active, than the eastern. As a general proposition it is stated that in the northern hemisphere the southern side of an east or west flowing glacier will be the more active and have its strongest movement toward the south. It is recognized that the influence of diurnal temperature may in certain cases be counteracted by other conditions.

TODD, J. E. *Hydrographic History of South Dakota.* Bull. Geol. Soc. Am., Vol. XIII, pp. 27–40, 1902.

The paper opens with a discussion of orogenic movements before the Pliocene, concerning which but little is known. The movements in the Pliocene are then taken up, and the development of the present streams in the portion west of the Missouri. These streams are thought to have made their way eastward to the James River valley, and several other peculiarities of drainage are mentioned. In the early Pleistocene the streams are represented as flowing over the same channels as in the Pliocene, for it is thought that the Kansan ice-sheet did not occupy the James River valley. During the later Pleistocene the James River valley was filled and the present course of the Missouri River is thought to have been inaugurated.

IOWA.

CALVIN, SAMUEL. *Geology of Page County,* Iowa Geol. Survey, Vol. XI, pp. 398–460, 1901.

The topography is characterized as an eroded drift plain, and the erosion is considered much more mature than in southeastern Iowa on the Kansan drift. The question is raised whether this drift may not be pre-Kansan. The valleys are partially graded up by a somewhat pebbly silt of loess-like aspect, and this grading up took place after the valleys reached their present large dimensions. Attention is called to a pebbly bed which occurs on the higher parts of the slopes at the base of the loess, which is thought to be the result of the removal of the fine parts of the surface of the till sheet and a resulting concentrating of pebbles. The statement that no such pebbly bed occurs in eastern Iowa is too broad, for the reviewer has noted it at the junction of the loess with the underlying Illinoian till sheet. (See JOURNAL OF GEOLOGY, Vol. VI, p. 181.)

CALVIN, SAMUEL. *Concerning the Occurrence of Gold and Some Other Mineral Products in Iowa.* Am. Geol., Vol. XXVII, pp. 363–72, 1901.

It is shown to be a fallacy that the topography of Iowa throws light upon the occurrence of valuable minerals deep in the earth. The presence of gold in the glacial deposits is also no indication of gold in the underlying rocks, since it has been derived from areas of crystalline rocks far to the north. It is also noted that gas, such as occurs in drift deposits near Herndon and Letts, is not to be taken as indication of larger amounts in underlying rock strata, for it appears to be formed from vegetation included in the drift.

CALVIN, SAMUEL. *Concrete Examples from the Topography of Howard County, Iowa.* Am. Geol., Vol. XXX, pp. 375–81, Pls. 27, 1902.

Descriptions and photographic views are given of the Loess-Kansan drift area, the loess margin, and the Iowan drift plain. The Loess-Kansan area presents a mature type of erosional topography, while the Iowan drift plain is very slightly eroded. The erosion contrasts are in line with other evidence, such as weathering and oxidation, in showing that the Kansan drift is many times older than the Iowan drift, or than its own coating of loess. It is considered a conservative estimate to give the Kansan drift an age fifty times as great as the Iowan.

FARNSWORTH, P. J. *When Was the Mississippi Valley Formed?* Am. Geol., Vol. XXVIII, pp. 393–96, 1901.

The present stream is in process of re-excavating a very old valley, whose floor was cut to a level more than 100 feet below the low water level of the river. The erosion is thought to have begun far back in Paleozoic times.

Finch, G. E. *A Terrace Formation in the Turkey River Valley, Fayette County, Iowa.* Proc. Iowa Acad. Sci., Vol. VIII, pp. 204–6, 1901.

The terrace is in a valley that heads in the drift covered, but passes into the driftless region of northeastern Iowa. The material found in the terrace is shown in the following section:

	Feet
1. Surface soil of loess-like character	2–3
2. Limestone fragments with a few glacial pebbles and with inclusions of blocks of loess	6
3. Loess-like material with soil at top	8
4. Iron-stained pebbly bed largely of local rocks, but containing green stones and quartz pebbles	3

Leverett, Frank. *Old Channels of the Mississippi in Southeastern Iowa.* Ann. of Iowa, Vol. V, pp. 38–51, Des Moines, 1901.

After calling attention to the several stages of glaciation that have influenced the course of the Mississippi, an attempt is made to outline the course the river took during each glacial stage.

Leonard, A. G. *Geology of Wapello County.* Iowa Geol. Survey, Vol. XII, pp. 439–99, 1902.

The physiography is discussed on pp. 443–48; the Pleistocene deposits, on pp. 472–75, and water supply and soils, on pp. 496–99. The part of the county northeast of a line running through Kirkville, Dahlonega, Agency, and Ashland is less deeply eroded than that southwest of it, but the entire county was originally a drift plain sloping southeastward. This difference in topography is explained by the relation to river systems and resulting gradients. The deeply eroded part is tributary to the Des Moines River, whose course to a given point on the Mississippi is more direct and the gradient steeper than that of Skunk River, which drains the less deeply eroded northeastern part. Attention is called to the greater width of the valley when in the soft Coal-measures than it is in the more resistant St. Louis limestone, the proportionate width being as 5 to 3. The Des Moines appears to be a re-established stream along a preglacial line. Its selection of the old course is thought to have been brought about by an incipient sag produced by the greater settling of material where the drift is very thick, an idea earlier brought out by Bain.[1]

The average thickness of the drift in this county is estimated to be not more than 100 feet, but the maximum may reach 200 feet. The county is entirely outside the limits of later drift sheets than the Kansan, though that drift is capped by a few feet of loess apparently of Iowan age. The surface of the Kansan drift is deeply weathered for 10 to 12 feet below the base of the loess.

MacBride, T. H. *Geology of Clay and O'Brien Counties.* Iowa Geol. Survey, Vol. XI, pp. 461–508, 1901.

The physiography is discussed on pp. 463–82; the Pleistocene geology, on pp. 482–89, economic products, on pp. 491–98, and forestry notes, on pp. 498–508. As these counties lie almost wholly within the limits of the Wisconsin drift, the drainage is very immature, and the chief contrasts in topography are such as are afforded by moraine and drift plain. The morainic topography is very largely comprised in the eastern range of townships of Clay county. There are wide tracts of plane-surfaced gravel outside of this moraine, and the gravel is found to be covered by a loess deposit that must be younger than the loess of the eastern part of the state, which is correlated with the Iowan drift-sheet. The thickness of the drift in these counties is remarkable. A well at the county farm in O'Brien county, east of Primghar, is reported to have reached a depth of 700 feet, nearly all blue clay, and a well on the Boyd farm in Caledonia township, said to be 1,000 feet deep, is through the blue clay nearly all the way. The altitude of the drift surface at these wells is about 1,500 feet above tide.

---

[1] Iowa Geol. Survey, Vol. VII, p. 280, 1897.

MACBRIDE, T. H. *Geology of Cherokee and Buena Vista Counties.* Iowa Geol. Survey, Vol. XII, pp. 303-53, 1902.

The physiography is discussed on pp. 306–16; Pleistocene deposits, on pp. 316–38; soils, clay industries, gravel, and water supplies, on pp. 338–43, and forestry notes on pp. 344–53. The contrasts in topography of the Wisconsin and the older drift of that region are clearly brought out. The drift, which in the report on Clay and O'Brien counties, was thrown into the Wisconsin, is here considered a possible early Wisconsin, while that bordered by the Altamont moraine is thought to be the probable limits of the Late Wisconsin. Further data are presented concerning the great thickness of drift in that region. A well at Marcus in the western part of Cherokee county, on ground standing 1,455 feet above tide, reached a depth of 680 feet without entering rock. This well is outside the limits of the Wisconsin drift.

MILLER, B. L. *Geology of Marion County.* Iowa Geol. Survey, Vol. XI, pp. 127-97, 1901.

The physiography is discussed on pp. 131–40; Pleistocene deposits, on pp. 163–69; water supplies, on pp. 193-96; soils, on pp. 196, 197; the remainder of the report being devoted to the hard-rock geology. This county is outside the limits of the Iowan and Wisconsin drift-sheets, and has the topography of an eroded drift plain such as characterizes the Kansan drift elsewhere. The South Skunk and Des Moines Rivers are apparently re-established along the course of preglacial valleys. The remainder of the drainage is largely in new lines. It is noted that the streams have a tendency to flow along the base of the south bluff, and in explanation two causes are given, one being the influence of the rotation of the earth, brought to notice by Gilbert, the other the different rates of decomposition of rocks on the two sides, to which Calvin has given the preference in earlier reports of the survey, it being thought that freezing and thawing alternating rapidly on the north side of the valley break up particles, so that they are more easily transported into the valley than on the more shaded and longer frozen south side. Another cause brought out by John T. Campbell in 1884 is not considered.[1] This explains the low inclination of south-facing drift slopes to the creeping of the deposits on those slopes, which is favored by their deposition by a south-flowing current of ice.

NORTON, W. H. *Geology of Cedar County.* Iowa Geol. Survey, Vol. XI, pp. 279-396, 1901.

The physiography is discussed on pp. 284–300; the Pleistocene deposits, on pp. 343-77; soils, on pp. 389-96. The Iowan and Kansas drift plains present marked contrasts in amount of erosion in this as in other counties of eastern Iowa.

---

[1] Am. Nat., Vol. XVIII, 1884, pp. 367-79.

The paha which are distributed near the border of the Iowan drift are found to be composed in part of Kansan drift, and are thought to be probable Kansan drumlins, though it is considered singular that they should be congregated around the border of a later sheet of drift. The deeply weathered surface of the Kansan, with its ferretto, is discussed very fully. Pre-Kansan drift is found in the deep part of the thick drift filling the preglacial valleys, but seems to be very sparingly represented on the uplands.

A preglacial channel called Stanwood River is traced through the county along a course parallel with and a few miles east of the Cedar River, the latter being largely in a postglacial course. From what seems to the reviewer to be an insufficient number of data, the gradient of the bed of this preglacial river is estimated to be 7 feet per mile, which is many times that of the neighboring portion of the preglacial Mississippi. As the valley of Stanwood River appears to have been a prominent tributary of the Mississippi, and since the valley of the Mississippi has a rock floor descending about one-half foot per mile, one would scarcely expect the gradient of this tributary to exceed one foot per mile. Attention is called to the incursion of some of the streams of the county into the edge of rock bluffs, which is thought to be due to an initial course given by the glacial drainage when the broad valleys were blocked by ice.

SAVAGE, T. E. *Drift Exposure in Tama County.* Proc. Iowa Acad. Sci., Vol. VIII, pp. 275–78, 1901.

A railway cut three miles west of Toledo, Ia., exposes what appears to be the Aftonian soil between sheets of Kansan and pre-Kansan till. The pre-Kansan till is thoroughly leached of its calcareous matter to a depth of 18 to 24 inches below the soil and partially leached to a depth of 6 feet. It is also changed to a reddish color to a depth of 3 or 4 feet, beneath which it is unoxidized. The soil is 1½ feet thick, dark brown in color, and carries numerous small fragments of wood and dark-colored bits of organic matter.

SAVAGE, T. E. *Geology of Henry County.* Iowa Geol. Survey, Vol. XII, pp. 237–302, 1902.

The physiography is discussed on pages 241–53; Pleistocene deposits, on pp. 289–95; soils, on pp. 297, 98; water supply, on pp. 301, 302; the remainder of the report being given to hard-rock geology. The effect of the Illinoian ice invasion in disturbing the drainage is discussed; also a probable post-Illinoian deflection of Cedar Creek into Skunk River. The Illinoian drift extends only a few miles into the southeast part of the county, the remainder being a Kansan drift area. In general the Kansan drift is greatly eroded, but in the northeast part of the county the channeling is very shallow, a feature which is explained by remoteness from a master stream. Gravelly deposits found at the surface of the Kansan drift are noticed and classified as Buchanan gravels. These gravels are of very limited extent compared with a deposit of gummy and slightly pebbly clay known as "gumbo," which caps the Kansan and also the Illinoian drift, and underlies the loess, but which is not noticed in this report.

SHIMEK, B. *The Loess of Iowa City and Vicinity.* Bull. Lab. Nat. Hist. State Univ. Iowa, Vol. V, pp. 195–216, 1901.

The loess at this locality, like that of much of eastern Iowa, is fine and homogeneous, and has a thickness of 12 to 15 feet. The loess fauna has perhaps been more fully studied here than in any other locality, and the paper deals mainly with this fauna. The molluscan fauna is found to point to comparatively dry, upland, terrestrial conditions during loess deposition, such as exist over the greater part of Iowa today.

UDDEN, J. A. *Geology of Louisa County.* Iowa Geol. Survey, Vol. XI, pp. 55–126, 1901.

The physiography is discussed on pp. 60–65; wells and water supply, on pp. 96–100, 125, 126; Pleistocene deposits, on pp. 101–14; clay industries, on pp. 119, 120; drift gas, on pp. 121–24; soils, on p. 125. In the discussion of drainage attention is called to divides which stand at the very brow of the west bluff of the Mississippi River, and of part of the Iowa River. It is thought that these large streams have widened their valleys sufficiently to reach divides separating them from small streams to the west. A contour map shows the altitude of the rock floor and levels reached by wells that did not strike rock. The rock surface of an upland in the southwest part of the county stands 650 to 720 feet above tide, while that of a lowland which occupies the remainder of the county averages scarcely more than 400 feet. The drift probably averages 300 feet in depth in the townships east of Iowa River, and ranges from 20 to 200 feet in townships west of the river.

Three sheets of bowlder clay are recognized—the pre-Kansan, Kansan, and Illinoian. The youngest, or Illinoian, covers all of the county except a narrow strip on its western edge. The pre-Kansan drift contains much wood, fragments of coal, and about twice as many fragments of local rocks as the higher drift sheets. Of the crystalline rocks it contains more greenstone, hornblende rock, and schist than are found in either of the other drift sheets, and a smaller proportion of dolomitic limestone, and of rocks common in the Kewenawan. This lowest drift sheet is poorly represented on the upland, but is a heavy deposit on the lowland tract and in preglacial valleys that traverse the upland. Between the pre-Kansan and the Kansan the Aftonian soil and a sand deposit have been found. The Kansan drift is jointed, with oxidized seams in the joints, and contains diabase, granite, and Kewenawan rocks, in larger amounts than the pre-Kansan. The Illinoian drift contains a large number of dolomitic rocks brought from neighboring outcrops to the east, and a comparatively few crystalline rocks. A few exposures of Yarmouth soil separating the Illinoian from the Kansan drift were noted, and a large number of exposures of the Sangamon soil between the Illinoian drift and the overlying loess.

Natural gas obtained near Letts is apparently from the Aftonian sand and soil horizon between the Kansan and pre-Kansan tills. The gas is probably partly from this soil, and partly from bituminous material in the pre-Kansan drift, which may include fragments of Sweetland Creek shale. The gas is in the upper part of the sand only, the lower part being filled with water. In fifteen different wells the pressure ranges from 4 to 10.5 pounds. The head of ground water is thought to be the principal factor which determines pressure. The depth of eight wells reported is 80 to 126 feet.

UDDEN, J. A. *Geology of Pottawattamie County.* Iowa Geol. Survey, Vol. XI, pp. 199–277, 1901.

The physiography is discussed on pp. 203–16; well records and water supply, on pp. 243–48, 273–76: Pleistocene deposits, on pp. 248–67; ice scorings, on pp. 268, 269; clays, on pp. 270–72, while the remainder of the report is devoted to hard-rock geology. This county is covered by a very thick deposit of drift which was apparently built up to a plane surface, with a slope, toward the south-southwest, of one to three feet per mile. The subsequent erosion has been so great that the surface is now nearly all embraced in the slopes toward the valleys. The valley bottoms are 50 to 200 feet below the upland plain, with a general depth of 100 feet. The grade of the steepest parts of the slopes is estimated to be about 13 feet to the 100, or 7° from the horizontal, but the average is much less. The drainage lines are apparently independent of preglacial courses, and it is suggested that the streams may radiate in conformity to glacial movements in this county. If the reviewer correctly interprets the hypothesis here advanced, the streams are thought to have had their start on the surface of the ice-sheet, and their courses determined by crevassing of the ice, but it is not made clear why the same kind of drainage may not have been developed on the drift surface after the ice had disappeared.

The average thickness of the drift is estimated to be 140 feet, exclusive of the loess, which has a thickness of about 60 feet. The surface of the till is not so much leached beneath the loess as in the Kansan drift in eastern Iowa. A dark blue-black till is found in the lower part of the drift which resembles the pre-Kansan till of eastern Iowa in color, structure, toughness, and position, and in containing vegetation, but the upper part of the till does not carry the distinguishing characteristics found in the Kansan of eastern Iowa. Its erratics appear to be of the same class as those of the blue-black till. The drift of this part of Iowa presents the rather anomolous and contradictory condition of being more eroded than that of the Kansan of eastern Iowa, and yet less weathered and leached. If one were to judge by the amount of erosion, it would be referred to the pre-Kansan stage of glaciation, but, judged by the amount of weathering and leaching, it would seem to be no older than the Illinoian, and possibly not older than the Iowan. It is well known that leaching progresses very slowly in arid districts, but it seems doubtful if the degree of aridity of western Iowa compared with eastern is sufficient to produce this difference in the amount of leaching. The rate of erosion should also be less in an arid than in a humid region, and yet the more arid western part of Iowa has the greater amount of erosion.

In the northern part of the county a "gumbo" separates the loess from the till on upland tracts, and the upper or gradual portions of the slopes. In places it appears to graduate upward into the loess, and downward into the till. It is more clayey than the loess, yet a mechanical analysis shows that about 95 per cent. of its material may be classed as loess. Interpretations concerning its origin are not reached, but it is suspected to be of diverse origin from place to place.

The loess is capable of separation into two distinct parts, especially the loess found in the valleys. The lower part is pebbly and shows clear evidence of water bedding. The upper part lacks these characteristics and appears likely to be a wind-deposited material. The reviewer would call attention to a feature which seems to indicate very clearly that the upper part of the loess on the borders of the Missouri valley in Iowa is wind-deposited. The topographic sheet of the Omaha-Council Bluffs district shows that the Iowa bluff stands considerably higher than the Nebraska bluff, and as the prevailing wind is from the Nebraska toward the Iowa bluff, it is thought that the latter has received the extra accumulation through the agency of the wind. A report on the loess mollusks made by Shimek (pp. 261–65) shows that the fossils are strictly terrestrial in nine out of the thirteen localities where collections were made, and in these remaining localities only two species of fresh-water pulmonates appear. In closing his report Shimek remarks that "the collection as a whole adds emphatic evidence of the fact, no longer to be doubted, that the loess was not of subaqueous origin." This unqualified statement appears rather singular in view of the fact that, in the report on this county, Udden calls attention to the presence of a water-deposited loess beneath the part of that formation thought to be wind-deposited.

UDDEN, J. A. *Loess with Horizontal Shearing Planes.* JOURNAL OF GEOLOGY, Vol. X, pp. 245–51, 1902.

The shearing planes here discussed were observed in Pottawattamie county, Iowa. They occur at the junction of the typical or pebbleless loess with a slightly pebbly deposit of loess-like material which underlies it. They appear to indicate a differential motion of the layers which they separate. The direction of movement is prevailingly from northeast to southwest, in harmony with the direction of general slope of the upland, but not in harmony with local topography. To account for the motion two hypotheses are suggested: (1) Tundra conditions may have prevailed, and the annual temperature changes caused creeping on a sloping plain; (2) there may have been glacial conditions. With a sudden onset of arctic climate, an extension of snow far beyond the margin of the ice seems probable, and an extra-morainic névé might develop. Such a snow-covered region would furnish ideal conditions for loess accumulation. A slow creeping of the entire field might take place in the direction of general slope of the land.

UDDEN, J. A. *Geology of Jefferson County.* Iowa Geol. Survey, Vol. XII, pp. 355–437, 1902.

The physiography is discussed on pp. 359–67; well records, on pp. 419–22; Pleistocene deposits, on pp. 422–29; glacial scorings, on p. 430; water supply and soils, on pp. 436, 437; while the remainder of the report treats of hard-rock geology. The drift of this county appears to have been left as a very smooth plain, with a gentle southeastward slope of 3 to 5 feet per mile. In this plain the rivers, creeks, and smaller streams have sunk their valleys 50 to 150 feet. It is estimated that from one-fourth to one-fifth of the total area of the county stands either at the original level of the plain or is included in the very gradual slope on the border between the plain and the steeper valley slope. The slopes are one-eighth to one-half mile wide, and show a rate of descent of 50 to 150 feet per mile, with the greatest pitch somewhat below the middle of the slope. The slopes facing the south are more gradual than those facing the north, and this is thought to be largely due to the rapid alternations of freezing and thawing to which the south-facing slopes are subjected. (See review of paper by B. L. Miller above, for other possible factors.) Terraces are found on Skunk River up to 125 feet above the stream, or 40 feet below the upland, and on Cedar Creek to 80 feet above the stream. The highest terraces have been shown by Leverett to be referable to drainage at the time of the Illinoian ice invasion. Udden doubts if they indicate a lower elevation of the land than now, for they seem, in Jefferson county at least, to have been dependent upon obstructions produced by rock sills in the valleys.

A list of twenty-seven wells shows a variation of but 110 feet in the altitude of the rock surface. If no deep-buried valleys occur which have been escaped in the borings, the reliefs of the rock surface are no greater than those of the drift surface.

The occurrence of weather-stained, leached, and partially indurated gravel beds at the base of the drift is noted. As these contain Archæan rocks, they appear to be glacial, but their age is not decided. A blue-black till 30–70 feet thick, which occurs in the lower part of the drift, is referred to the pre-Kansan stage of glaciation. Above this in some cases is a yellow sand separating it from the overlying Kansan drift. The sand is possibly of Aftonian age. A classification of the lots of 100 pebbles each from each of the drift sheets showed the upper or Kansan to have more hornblendic rocks, diabase, epidote, gabbro, red arkose, and chert, than the lower or pre-Kansan drift. The lower drift is found to have more of the greenstone, schists, slate, jaspilite, syenite, and Palezoic rocks than the Kansan drift sheet. A table shows to what different extent the several classes of rock suffered reduction in the glacial mill. The leaching of the Kansan drift surface varies within short distances from 4 to 12 feet in depth, because of the difference in texture or in drainage conditions. The thickness of the loess which covers the Kansan drift is about 12 feet, except on slopes, where it is 8 to 10 feet or less. Cross striæ were observed near Perlee bearing S. 35° E. and S. 70° W., but no attempt is made to explain this rather striking and unexpected feature.

WILDER, F. A. *Geology of Webster County.* Iowa Geol. Survey, Vol. XII, pp. 63–235, 1902.

The physiography is discussed on pp. 69–75; the Pleistocene deposits, on pp. 128–38; water supply, on pp. 185, 186; and soils, on pp. 189–91. There is thus but a small portion of this lengthy report devoted to Pleistocene features aud deposits. Webster county lies within the limits of the Wisconsin ice invasion, and the author calls attention to the slight amount of erosion and immaturity of drainage systems in this part of the Wisconsin drift sheet. The Des Moines River is thought to be in a pre-Wisconsin valley that was nearly filled with Wisconsin drift. The gravel terrace 150 feet above the river is thought to be of Wisconsin age. Attention is called to a recessional moraine south of Webster county, and two others in the north part of the county. There is also a weak one near Tara, previously noted by Upham.

MISSOURI.

MARBUT, C. F. *The Evolution of the Northern Part of the Lowlands oj Southeastern Missouri.* University of Missouri studies, Vol. I, No. 3, 63 pp. 6 Pls., 1902.

After describing the lowlands, with their intervening hills and ridges and the geologic formations of the region, the processes by which the lowlands were produced are considered. It is concluded that the streams which eroded the lowlands were the streams that now drain the region, and that the lowlands are so recent in their development that no complete rearrangement of drainage can have taken place since their erosion. It is thought that the Mississippi originally turned westward at Cape Girardeau and followed the course now occupied by the Advance lowland belt, and contemporaneously the Ohio eroded the Cairo lowland. The Ohio worked in loose sands and clays, while the Mississippi worked chiefly in hard limestone. The Ohio was therefore able in a given time to erode a much wider valley than the Mississippi. It is also probable that it was less burdened by silt than the Mississippi, and in consequence was able to bring its valley to a lower gradient. It is thought that the altitude at Cairo may have been 60 feet lower than at Cape Girardeau, points similarly situated on the parallel streams. This lower altitude of the Ohio gave it suffcient advantage over the Mississippi to result in the capture of the latter stream. The capture is thought to have first taken place through a gap between Benton Ridge and Crowley

Ridge, and later along its present course east of Benton Ridge. The paper also discusses the method by which smaller streams have been diverted or shifted from their old courses.

TODD, J. E. *River Action Phenomena.* Bull. Geol. Soc. Am., Vol. XII, pp. 486–90, 1901.

The phenomena discussed are mainly along the Missouri River. Attention is first called to the deep scouring which occurs at flood stages of the river, a depth of 50 to 100 feet being frequently reached. Several corrollaries are to be drawn from this fact: (1) that bed-rock 100 feet below present low water does not demonstrate a buried channel; there must be present some other deposit than river alluvium, such, for example, as till; (2) that estimates of discharge at flood stages should include this deepening as well as the rise of the water; (3) the transfer of sediment down the valley should include the moving river bed as well as the material in suspension; (4) recent objects may be deeply buried by river deposits. In this connection the reviewer would call attention to deep scouring at St. Louis noted by Woodward, (C. M.) in his treatise on the St. Louis bridge, published in 1881. Soundings off the east abutment of the bridge made in 1876 showed a depth of nearly 100 feet of water where there was but 15 to 20 feet when the abutment was constructed. Concerning this Woodward remarks: "It is clear that either the mighty river had at one time its normal bed on the rock or else it has in ages past, during its countless floods, again and again scoured down to the rock itself."

The second topic treated in this paper is that of mutual flood relief channels formed just above the junction of two streams. They have been noted on many rivers.

A third topic shows that a flooded stream has its velocity checked by overflowing its flood plain, and as a result fine material is deposited.

KANSAS.

CHAMBERLIN, T. C. *The Geologic Relations of the Human Relics of Lansing, Kansas.* JOURNAL OF GEOLOGY, Vol. X, pp. 745–77, 1902.

HOLMES, W. H. *Fossil Human Remains Found near Lansing, Kansas.* Am. Anth., N. S., Vol. IV, pp. 743–52, Pls. 31–32, 1902.

UPHAM, WARREN. *Man in Kansas in the Iowan Stage of the Glacial Period.* Science, Vol. XVI, p. 355, 1902.

——— *Man in the Ice Age at Lansing, Kansas, and Little Falls, Minnesota.* Am. Geol. Vol. XXX, pp. 135–50, 1902.

——— *Primitive Man and His Stone Implements in North American Loess.* Am. Nat., Vol. XXIV, pp. 413–20, 1902.

——— *The Fossil Man of Lansing, Kansas.* Rec. of the Past, Vol. I, pp. 272–75, 1902.

——— *Primitive Man in the Ice Age.* Bibliotheca Sacra, Vol. LIX, pp. 730–43, 1902.

WILLISTON, S. W. *A Fossil Man from Kansas.* Science, Vol. XVI, pp. 195–196, 1902.

——— *An Arrowhead Found with Bones of Bison occidentalis Lucas in Western Kansas.* Am. Geol., Vol. XXX, pp. 313–15, 1902.

WINCHELL, N. H. *The Lansing Skeleton.* Am. Geol., Vol. XXX, pp. 189–94, 1902.

These papers, with the exception of the second one by Williston, pertain to human remains found on the Concannon farm near Lansing, Kan., in a tunnel which had been extended into the Missouri River bluff. The remains were found just above a rock shelf which is covered to a depth of 25 feet or more by an earthy material which by Upham and Winchell is thought to be loess of Iowan age, but by Chamberlin is considered postglacial, and the product of aggradation at the mouth of a small tributary of the Missouri. Chamberlin's interpretation is indorsed by Calvin and Salisbury in brief statements which appear in connection with his paper. Williston's opinion, based upon the condition of the skeleton, would give it a respectable antiquity. Holmes considers the skeleton that of an Indian, and doubts if it is of great antiquity.

The second paper by Williston discusses the occurrence of an arrowhead and bison bones in a deposit which seems to be loess-like in character and possibly of Iowan age.

MISSISSIPPI.

SHIMEK, B. *The Loess of Natchez, Mississippi.* Am. Geol., Vol. XXX, pp. 279–99, Pls. X–XVI, 1902.

More than fifty exposures of loess were examined at Natchez and several at Vicksburg. It was found that the thickness had been overestimated by earlier investigators. Instead of 50 or 60 feet, its maximum thickness is only 25 or 30 feet. Like the northern loess, it mantles the slopes as well as the divides. Like the Missouri River loess, it is coarse and contains much lime. The molluscan fauna is, however, different from that of the northern loess, there being no pond species intermingled with the terrestrial species such as occur in the northern loess. The entire list of species are not only terrestrial, but all are now found living either on the hills in the immediate vicinity or in similar situations in other parts of the South. Some of the most characteristic and widely distributed species of the northern loess are wholly absent, and others very rare in the southern loess. Eighteen species are thus far known only from the loess of the South. The author holds that the Natchez loess furnishes weighty arguments against both the aqueous and glacial theories of the origin of the loess. The aqueous theory is unsupported by traces of beaches and shore lines, etc., and the fossils are so fragile that it is considered highly improbable that they were transported by water. There is also nothing in the molluscan fauna which would suggest even the remotest possibility of a glacial climate, for the species are in large part such as inhabit the warmer parts of our country today. The author therefore concludes that the æolian theory offers the best explanation of the origin of the southern loess. The paper is illustrated by photographs of the exposures and drawings of many of the loess fossils.

LOUISIANA.

HARRIS, G. D. *Quaternary Geology and Water Supplies in the Mississippi Embayment.* Geol. Survey of Louisiana, Rept. for 1902, pp. 32–39, 215–52.

The Orange Sand is a deposit thought to have been under conditions of rising shore or falling sea-level, without definite time in the geological scale. Port Hudson clay is apparently a deposit made in a broad marsh or in shallow lakes during a long-continued sunken or sinking condition, and it appears not to be separated from the recent alluvium by any sharp line of demarkation. The lower limits also are not clearly shown, there being a transition into the Lafayette. Loess is thought to be represented at a few localities. The loess and the Port Hudson have been raised to moderate altitudes above the sea, and the deposits made in trenches cut in these formations constitute practically the last geological formation.

The mud lumps at the mouth of the Mississippi are briefly discussed and shown to be unlike volcanic cones running down outside a gas vent. They represent upheavals, produced probably in large part by gas, though the origin and agencies are not fully understood.

The water supplies from the Quaternary are discussed on pp. 215–52. The Lafayette sands afford a strong supply, and if overlain by the Port Hudson clay, the water usually shows a rise when struck. The head declines toward the Gulf and also toward the axis of the embayment.

UPHAM, WARREN. *Growth of the Mississippi Delta.* Am. Geol., Vol. XXX, pp. 103–11, 1902.

The data collected from notes of early explorers lead to the conclusion that in the four centuries since the delta was seen by Vespucci it has been extended in the passes some 10 or 15 miles. The extension of the delta from an old to a new group of branches or passes is thought to have been effected by the growth of one of the old passes so far beyond the others that it became the chief, if not the only, channel in ordinary stages of the river. It is predicted that, instead of extending forward in a third stage, the main current will forsake this lower course and descend to sea level some shorter way.

GENERAL.

DRYER, CHARLES R. *Lessons in Physical Geography.* 430 pp., 347 text Figs., and 20 full-page maps. New York: American Book Co., 1901.

The subjects treated are the earth as a planet, the land, the sea, the atmosphere, and life.

The aim of the book is to develop a scientific habit of mind in the study of physical geography. No attempt is made to discuss exhaustively the physical features of the earth, or of any special region; but the best type-forms are selected and treated with sufficient fulness to give a clear and definite picture. General laws are developed from a study of the type which may be applied wherever the problems to which they apply may arise. This plan makes it possible to avoid the vague generalizations which characterize too many text-books. A large number of realistic exercises are introduced which appeal to the actual or possible experience of a student. They aim to give some idea of the methods of geographic research, and include both field and laboratory work. The illustrations, which are many, are frequently drawn from the interior part of the United States, which has been poorly represented in previous works on physical geography.

ECKHOLM, N. *Meteorological Conditions of the Pleistocene Epoch.* London Quart. Journ. Geol. Soc., Vol. LVIII, pp. 37–45, 1902.

The area of Pleistocene glaciation in Europe and America corresponds with the areas now traversed regularly by frequent storm tracks. There seems to have been the same difference in mean annual temperature of Europe and America in the Ice age as now, and it is thought a lowering of the temperature sufficient to put the snow line 1,000 meters lower would bring on glaciation. The effect of glaciation on cyclones and anticyclones is thought to be the same as a cold winter. Reference is made to a paper by F. W. Harmer (reviewed below), which is thought to overrate the effect of wind on climate.

GILBERT, G. K. and BRIGHAM, A. P. *An Introduction to Physical Geography.* 380 pp., 263 Figs. New York: D. Appleton & Co., 1902.

The several chapters treat the following subjects in the order named: the earth, the earth and sun, rivers, weathering and soils, wind work, glaciers, plains, mountains and plateaus, volcanoes, the atmosphere, winds, storms, and cyclones, the earth's magnetism, the ocean, the meeting of the land and sea, life, the earth and man.

The study of the lands is brought in early in the belief that here is the sure appeal to the students interest and previous knowledge. For the same reason the more familiar features of the land are treated before those that are less common. The treatment, so far as possible, is concrete, and wherever practicable each subject is opened with a type case, in the description of which terminology is called forth and the principles begin to appear. It is believed that physical geography is a subject which lends itself to this method with special effectiveness. The illustrations are especially well selected and are closely correlated with the text.

HARMER, F. W. *The Influence of the Winds upon Climate during the Pleistocene Epoch.* London Quart. Jour. Geol. Soc., Vol. LVII, pp. pp. 405–78, 1901.

Since changes of wind today cause sudden and marked changes in weather, it is thought that a long-continued change in the course of prevalent winds in the past ages would produce great changes in climate. At present continental areas are hotter than oceanic during summer, and are therefore cyclonic; they are colder in winter and are then anticyclonic. Regions covered by ice during the glacial period may have been to some extent anticyclonic at all seasons, low-pressure systems prevailing at the same time over the warmer regions south of them and over the adjoining ocean. With such a change oceanic winds with copious rainfall may have prevailed over regions now arid, and mild winters where they are now severe. The paper makes use of weather charts from all over the world in discussing the climatic conditions now prevailing, and draws upon paleontological and other evidence in support of changes of climate to which various parts of the world have been subjected. It seems difficult to explain how the northern hemisphere could have been wholly cold at one stage of the glacial period or wholly mild at another, and it is suggested that no difficulties would arise if there was an alternation of glacial and temperate conditions on the two continents, it being mild in America while glaciation was prevalent in Europe, and *vice versa.* The paper is naturally very hypothetical, and, as noted above (see Eckholm), the areas of Pleistocene glaciation in Europe and America apparently correspond with areas now traversed regularly by storms.

REID, H. F. *Variation of Glaciers.* JOURNAL OF GEOLOGY, Vol. IX, pp. 250–54, 1901; Vol. X, pp. 313–17, 1902.

The first paper gives a summary of records of glaciers for 1899, the second for 1900. The great majority of glaciers are in process of retreat, the world over, but historic evidence shows that their fluctuations are complex and dependent on several factors.

Scott, A. C. *A Brief Summary of Glacier Work.* Am. Geol., Vol. XXX, pp. 215–61, 1902.

This summary was written as a seminary paper in a course in geology at the University of Wisconsin. When attempting to arrange an outline of the work it was found that the literature nowhere included a summary, hence the publication of the paper. Although not exhaustive, it attempts to cover the important topics of the subject.

True, H. L. *The Cause of the Glacial Period.* 162 pp. Cincinnati: The Robert Clarke Co., 1902.

The first 52 pages outline the main features of the drift, state the glacial theory, and discuss the several current hypotheses which aim to account for the glacial period. None of these, nor all of them put together, satisfy the author. Years ago he conceived the idea that a change of latitude might account for glaciation. In the remaining 110 pages the following topics are considered: (1) the inability of a change of the earth's axis to produce a glacial period; (2) the stability of the earth's axis; (3) time and climate; (4) causes of change of climate; (5) the glacial period still continues; (6) the glaciated region and probable thickness of ice during the maximum of glaciation; (7) the Champlain epoch; (8) evidence that the earth has toppled, together with a consideration of the objections; (9) an open polar sea.

The chief idea set forth in the book is that of a change of latitude or disturbance of the rotary motion of the earth produced by the weighting of the ice-covered region. The buried channels of the glaciated region, which are commonly interpreted to indicate a former high altitude of the land, are here interpreted to indicate that the land stands nearer the equator than it did when they were cut. The northward rise of the marine beaches and beaches of the great glacial lakes of the eastern part of North America are interpreted to indicate that the region is swinging away from the equator instead of undergoing an uplift. The reviewer would call attention to the fact that these beaches do not show a continuous northward rise, but stand higher for example, on the borders of Lake Champlain than they do considerably farther north on the borders of the Gulf of St. Lawrence, and even higher than at the extreme north end of the Labrador peninsula, as determined by A. P. Low (see papers reviewed above). The geological evidence appears to bring little or no support to the hypothesis that extensive changes of latitude have occurred. If there has been an oscillation of latitude as a result of the weighting of the glaciated region and subsequent melting, physicists and astronomers may be able to calculate its amount. The subject seems an inviting one for investigation.

ADDENDUM — CONNECTICUT.

Eggleston, J. W. *Some Glacial Remains Near Woodstock, Connecticut.* Am. Jour. Sci., 4th series, Vol. XIII, pp. 403–8, 1902.

A probably expanded stage of Woodstock pond is noted, and neighboring glacial features consisting of kames, eskers, kettleholes, and drumlins are described. These features are largely restricted to the lowlands. The ridges, which in that vicinity stand about 300 feet above the lowlands, carry a smooth-surfaced drift.